

Redescription of the genus *Helicarion* and of
Helicarion niger (Quoy & Gaimard, 1832)
From Victoria (Pulmonata: Helicarionidae)

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ABSTRACT

New and expanded descriptions of the endemic Australian ariophantid genus *Helicarion* Ferussac 1821 and the Victorian species *H. niger* (Quoy and Gaimard, 1832) are provided. A specimen in the Paris Museum is selected as lectotype. Voucher specimens on which anatomical observations have been made are deposited in the National Museum of Victoria.

INTRODUCTION

Taxonomic and ecologic study of the Australian helicarionid fauna over a number of years has demonstrated the need for stabilization of the genus *Helicarion*. The two species, *H. rubicundus* Dartnall and Kershaw, 1978 and *H. cuvieri* Ferussac, 1819 (Kershaw, 1979), now recognised in Tasmania, have been described in detail with notes given on the status and limits of the genus. The object of this paper is to provide an adequate redescription of the genus and to redescribe the Victorian species *H. niger* (Quoy & Gaimard, 1832)

Effective establishment of the status of the genus *Helicarion* has significance to the understanding of ariophantacean taxa. It occupies the southern limit of helicarionid distribution and probably demonstrates primitive or specialised features. The Helicarionidae and the Ariophantinae are apparently closely related (Solem, 1966; Van Mol, 1973). But little is known of other helicarionid Australian genera. The establishment of these depends on the definition of *Helicarion*. Subsequently may come the hypotheses concerning apparent relationships and the primitive or specialised nature of morphology. Some basic taxonomic data are provided by Thiele (1931) and Zilch (1959-60). Brief ecological notes have been presented by Kershaw (1957, 1975).

**HELICARION
MORPHOLOGY**

Helicarion has no functional verge but there is frequently a small simple or complex penial papilla. There is no dart-sac, sarcobelum, retractor caecum or elaborate atrial diverticulum. These items suggest a relatively simple animal but it has the features of helicarionid slug evolution (the semi-slug morphology) of reduced simple shell, mantle lappets, and tripartite foot sole with caudal features. The small coiled flagellum contains at appropriate times, an elaborate spermatophore, the spiny section of which is always extruded last. Significant study error is likely if the spermatophore is partially digested in the bursa. Sometimes broad thin salivary glands can be clearly observed adhering to the anterior oesophagus. The radula has clear family features in the basic tooth shape. The convex raised lateral ridges of the base plate have been recognised whenever helicarionid radulae have been available for study. Radula differences rest in tooth morphology and number. Considerable study is still required particularly in Australian genera other than *Helicarion* in which a start has been made.

DISTRIBUTION

Within Victoria, Tasmania and probably part of south-east New South Wales; past ideas having been very largely due to variable body colours coinciding with the simple shell. Hence almost any blackish animal was labelled *H. niger*, but evidence is emerging to suggest that colour is frequently an ecological factor. Thus Smith's (1977) concept of *H. niger* distribution is difficult to substantiate. Population studies (Kershaw, 1980) reveal considerable colour variation indicating the complexity of the problem. More work is needed, particularly in New South Wales. Other genera will require separate study.

TAXONOMY

Helicarion Ferussac, 1821.

type by subsequent designation: Gray, Proc.Zool.Soc. 1847:169,
Helicarion cuvieri Ferussac, 1819.

DIAGNOSIS

Small to medium animals with weakly sculptured, few whorled reduced sub-globose shells with depressed spire, pale yellow to light orange sometimes tinted green, imperforate. Radula with tricuspid central teeth, bicuspid non-denticulate marginal teeth. Penis with distinct internal ornament often including a small, simple or complex, penial papilla. Verges, dart-sac and retractor caecum absent. Flagellum small, short, more or less coiled. The spermatophore, sometimes clearly visible within the flagellum lumen, has a section of distinct branching spines which is always extruded last during copulation in this genus.

DESCRIPTION

Shell thin with shallow barely margined sutures, whorls 3 to 3.5, aperture relatively wide but shell not usually large. Mantle not large, lappets often well defined but rarely reaching beyond shell apex, usually with spots or wart-like ornaments, one central, one posterior. Tail normally with a short keel often extending to a caudal horn overlapping the shallowly recessed caudal gland (foss of authors). Foot tripartite, relatively narrow, narrowing posteriorly. Body ornament rugose in variable pattern usually in slanting anterior and posterior alignment, with pale or neutral shades often colour tinted, uniformly coloured but colour pattern only known from south-east Tasmania. The single distinctly sloping line of the anterior flank is a family feature. Jaw with a central process, radula with rachidian tricuspid, laterals tricuspid including a minute endocone, marginals simple narrow curved bicuspid, usually 2 or 3 clear latero-marginals, rachidian baseplate with the helicarionid laterally convex distinct lateral ridges. Genitalia, relatively simple as defined, has no significant atrial diverticulum, but a small vaginal chamber may form a simple diverticulum or often pass almost directly on into the uterine duct. The atrium and vagina are small with the bursa duct junction close to the atrium. Internal ridges curve from the bursa duct abruptly to the vagina at the chamber entrance. The flagellum may be slightly, but is never greatly extended. It has distinctive external ornament coinciding with internal crypts within which spines form. The vas deferens often has a distinctive point of insertion with the flagellum allied with other specific features. Penis usually with some form of basal bulge, sometimes very small, containing a chamber within which the penial papilla may be, and other distinctive ornament is present. The penial sheath is thin, extending from attachment at atrium to base of penis. The penial retractor muscle is situated at or closely adjacent to a variably sharp bend in the epiphallus. It may arise from a small distinct process. The sheath retractor muscle, rarely reaching beyond the epiphallus to the penial retractor base, is thin sometimes branching. The bursa copulatrix is moderately elongate, variably bulging, often but not always lined with variable plicae. Its duct is normally, sometimes variably, lined with distinctive longitudinal ridges, the pattern apparently related to specific penial ornament.

SPECIES DIAGNOSIS

This study, to the completion of the present paper, has involved some 1500 specimens. Although many consisted of the shell only, a very large number of animals have been used in morphological studies. Limitation has been imposed by shortage of animal material

from many parts of Australia including southern pockets not readily accessible. It has been aided by many strategically located samples throughout. In addition, a survey of the Lower Gordon River region of Tasmania by university staff has provided valuable information. Many years are expected to elapse in completing an initial study of the family in Australia. Study of the genus *Helicarion* has necessarily received precedence and in defining the genus the need to study the south-eastern Australian fauna was evident. This study has simplified the study and description of species.

The existence of many races and actual or probable undescribed species has been revealed. In determining their status many factors need study and literature study has shown that both old and new problems exist. Shell features require care in usage. The use of spiral grooves as a specific character is a good example which has been found at random in Australia. Colour has been found variable, including a range of neutral or colour shades which may differ within or between populations. Greenish shell tints occur in shells independently of genera or species. Certain animal colours, constant in live animals, are lost in preservative leaving a whitish specimen. Foot length may be reduced by up to two-fifths in preservative. But obtaining accurate live measurements requires care and is limited by insufficient fresh material.

The radular row number of 130 in *H. cuvieri* is accepted as a reasonable mean. Other estimates are omitted to reduce potential error among species. Radular tooth number differs with the age of the animal as with other Pulmonates (Runham, 1975). The radula has been suggested as of generic value only but study to date raises doubt on the validity of this. Shell and animal size vary greatly and are related to populations with difficulty, creating analytical problems. Stable criteria are a prime need.

Nitor with an heliciform shell provides a very different animal-shell relationship to *Helicarion* the shell of which can shelter relatively little of the animal. But *H. niger* can withdraw much of the animal. But the quotation by several authors from Quoy on this aspect actually refers to the neck. Three species have been described for *Helicarion* with significant but relatively restricted distribution known. The genus as defined, is based on a much wider range of morphs allowing presentation of a generic description at this stage.

HELICARION NIGER (QUOY AND GAIMARD, 1832). TYPE LOCALITY WESTERN PORT, VICTORIA

1832 *Vitrina nigra* Quoy and Gaimard, *Voy.Astrol.Zool.* 2:135, pl.11.

1855 *Helicarion nigra*. Gray, *Cat.Pulm.Collt.Brit.Mus.* i: 68

1868 *Vitrina nigra*. Cox, *Mon.Aust.Land Shells.* p 84, no. 204.

1882 *Vitrina nigra*. Tate, *Trans.R.Soc.S.Austr.* 4: 75.

1909 *Vitrina nigra*. Petterd & Hedley, *Proc.Linn.Soc.N.S.W.* 7: 301.

1912 *Vitrina nigra*. Cox & Hedley, *Mem.Nat.Mus.Vict.* 4: 14.

1930 *Vitrina nigra*. Gabriel, *Proc.R.Soc.Vict.* 53 (1): 85.

1937 *Helicarion niger*. Iredale, *Aust.Zool.* 9 (1): 7.

1972 *Helicarion niger*. Smith, *Vict.Nat.* 89 (12): 348.

Habitat. Sclerophyll forest and scrub.

Both Cox (1868) and Gray (1855), although differing slightly in interpretation, quote the brief shell description from Quoy, adding the comment "animal black, large, neck elongate contractile into the shell". The animal is able to withdraw a large proportion of itself within the shell, the shape of which may facilitate this characteristic.

SPECIES DIAGNOSIS

Helicarionid snail with shell small to medium size, depressed sub-globose, bright golden yellow sometimes tinted orange; spire flattened, sutures very shallow, aperture roundly ovate; animal pale or dark grey rarely black, with faint buff or pinkish tint, lappets pale; extremities, particularly tail, noticeably darker. Protoconch sculpture spiral striae. Adult weakly radially sculptured on slight surface undulations. Radular formula 38.15.1.15.38, rachidian and lateral mesocones relatively broad with a small distinct depression at the mesocone base. Penial anatomy with a small rounded fleshy penial papilla and internal ornament of close erect papillae arranged in a longitudinally triangular pattern. Spermatophore relatively simple.

TYPE LOCALITY

The type was collected in the vicinity of Western Port Bay, Victoria. The only other data known is that given by the authors. Inspection of this large region indicates that *Helicarion niger* probably no longer exists in the original vicinity as a large proportion of the environment has undergone complete change. Fortunately areas remain within which populations have been available for study. These have defined an area from Port Phillip Bay to Wilsons Promontory. To the north the region near Leongatha, Trafalgar, Korumburra are included but scarcity of material, change of environment and possible racial differences make a final decision difficult. The region is largely low coastal country to low hills with scrub and dry sclerophyll forest significant. No evidence has yet emerged that the species occurs in the mountains or anywhere else in south-eastern Australia.

TYPE MATERIAL

The Paris Museum of Natural History. One shell.
 Label: "Vitrine de Western. Vit. nigra q g.
 cat. pl. 11 fi.8, 9n elle h n pt. western.
 11° 7 a du Cat du Ue."

The plate and figures quoted are from the Astrolabe report. The label is very old and while the word type does not appear it is apparently original material. The shell is believed to be the type by the Paris Museum and was loaned for study by M. Tillier on that basis. It is the only specimen and in terms of Article 73 of the Code as there is no evidence to indicate that it is not original material it should be regarded as the holotype. The dimensions are maximum diameter 11.7mm, minimum diameter 9.4mm, height 5.5mm, aperture length 5.7mm, width 5.7mm. There is therefore a discrepancy in the maximum diameter which suggests that more than one specimen was collected. The existing shell is very fragile with a probably limited life. A voucher specimen has been selected with the probability in mind that the existing type will be replaced. In addition a series of animals from the type region have been preserved as part of the voucher collection. Because there is a discrepancy the existing shell must here be designated a lectotype.

This material is listed under the heading of material examined (and believed to be *Helicarion niger*).

DESCRIPTION OF TYPE (Figure 1)

Shell faintly orange-yellow almost opaque, flattened above, periphery rounded, protoconch almost white, about 1.5 whorls ending with a depressed area. The sculpture is very fine irregular microscopic radial lirae, the numerous close very fine microscopic spiral striae clearly distinct under high power. Adult sculpture irregular, low variably rounded radial riblets with much finer radial lirae, very vague spiral striae, very faintly rugose shining surface. The three and one quarter whorls rapidly increase, last moderately expanded, aperture roundly ovate, sutures clear very narrowly margined. There are several faintly orange radial colour bands and the radial sculpture is very clear in some places. Imperforate.

Description of '*Vitrina nigra* Quoy and Gaimard, 1832' translated from the "Voyage of the Astrolabe", p.135:

This Vitrine is oval, elongate, a very little rounded on top, the spire rather depressed, very short, the last whorl very large. The sutures are well marked, the aperture is very broad, elliptical, its left margin is a little pointed, from within outwards. The shell is translucent, glossy blond approaching tawny.

The animal in spite of its size can be contained in its shell. The neck is long, the posterior tentacles are thick short, swollen at the extremities which carry the eyes. It is difficult to see in the living creature the ear-shaped entrance of pulmonary aperture, as well as the right and left appendices of the mantle, which do not cover the shell. They are distinguished better after the death of the mollusc. The foot which is prolonged to a point bears on its extremity and underneath apparently a mucous pore, a fact which is contrary to other Vitriines, which have the depression above. The whole animal is black. It inhabits

Western Port in that part of New Holland which overlooks Bass Strait. We found it on the banks of a stream.

The port of King George has provided us with smaller specimens, living under the trees, far from fresh water.

Dimensions. Length of the shell . . . 6 lignes

Thickness 2½ lignes

(i.e. 13.5mm length, 5.64mm depth.)

Description of Voucher Specimen (Figure 4):

Shell: 3.25 whorls rarely larger, normally golden yellow becoming opaque with age. Protoconch 1.5 to 1.9 whorls pale blue grey to almost white, sculpture very fine faint clear close spiral striae sometimes with irregular radial lirae normally ending with slight depression. Adult sculpture very weak radial lirae, some stronger more widely spaced, on body whorl slight surface undulations. Animal very faintly buffish or pinkish grey with darker extremities, much of tail distinctly dark, caudal margin may be black, tentacles dark grey, lappets pale. Right pallial lappett triangular 5 mm long, 3.5 mm wide, in life adhering laterally to shell, one black spot at extremity, one basally 2 mm from extremity; right body lappett 5 mm long, 4 mm wide below suture, a small basal curve narrows to 2 mm; left pallial lappett elongate triangular 2 mm wide narrowing to 1 mm with black spot 1.5 mm from extremity, 4.5 mm long, curving across lip margin of shell dimensions 11.7 mm maximum, 9.3 mm minimum diameter. Mantle extends 2 mm along neck to 5 mm from muzzle. Ocular tentacles 2.5 mm long, closely spaced. Genital atrium slit-like, a clear round 1.2 mm depression expanded, penis pale yellow. Foot sole pale, central section narrow about one-fifth of width, slightly narrower over posterior one third, lateral sections convex, narrow line of tubercles above peripodial groove weakly defined; foot narrow throughout, posterior keel one fifth of tail length or less, pneumostome well-defined with white tissue below. Body ornament irregular shaped somewhat weakly variably defined tubercles, moderately aligned longitudinally on neck, in slanting lines on tail (Fig. 5).

Anatomy: Jaw (Fig. 12) yellow translucent, distinctly arcuate, extremities pointed, central projection gently arched, sharpened.

Radular (Figs. 2, 3) formula 38.15.1.15.38. Rachidian tricuspid with relatively broad somewhat 'spear head' shaped mesocone, ectoconal cusps at about half length of tooth, distinct from mesocone, curved above, arched below, separated by a variable trough, passing to distinct pits posteriorly, anterior one quarter of tooth with variable low ridges and troughs extending to two projections variably scalloped between. Lateral teeth with relatively broad mesocone, more robust than rachidian, laterally sub-curved with a small endoconal cusp at one-third length of mesocone; ectoconal cusp distinct, similar to and in line with rachidian ectocones; anterior of tooth with undulating surface posterior to trough adjacent ectocones, straightened at junction with next anterior tooth. (In specimens from Mornington the anterior edge of the lateral tooth is produced to engage a recess in the next anterior tooth). Marginal teeth bicuspid distinctly curved anteriorly then gradually to cusp tip, broadened centrally, ectocones distinctly curving away from mesocone at first. Rachidian base plate with two inner minor ridges loosely engaging with posterior of next tooth, column of tooth sturdy, upright, then slanting sharply to mesocone cusp. Lateral base plate engaging anteriorly and laterally closely with anterior of next tooth.

Reproductive system (Figs. 8, 10, 13): penial complex sharply 'U' shaped with retractor muscle lateral to extremity of curve. Retractor muscle base slightly bulging curved sub-rounded 0.5mm diameter. Penis (Figs. 6,8) distinctly basally curved narrowing abruptly to epiphallus with at junction a small fleshy papilla; penial sheath very thin with retractor attached to epiphallus just short of curve (Fig. 13). Penial retractor basally connected by a vein to vascular system adjacent stomach via oviduct and albumen gland near pericardium (Fig. 10). Flagellum spiral with lateral raised flange ornamented with defined protuberances distinctly bulging at epiphallic junction (Fig. 8) varying from one sixth to almost one third complex length in different populations, internally a defined lumen lined with crypts corresponding to external ornament. Vas deferens inserts laterally adjacent but opposite basal bulge 2.7mm from flagellum tip varying from two-fifths to nine-tenths length (Fig. 8,Q). Penis lined with sub-longitudinal slightly zigzag tightly folded lines of

papillae arising from low ridges, denser and spreading diagonally at base (Fig. 6). Spermatophore (Fig. 9) short, coiled with eight, most branching, simple spines loosely grouped. Epiphallic duct lined with sharp distinct pilasters to retractor, thin low rounded close somewhat zigzag pilasters to flagellum. Bursa copulatrix (Fig. 8) cream short bulging connected by a long (half to three-fifths length) duct closely adjacent to atrium. Bursa duct lined with bold pilasters some curving to vagina. Several pilasters pass from vagina to atrium (Fig. 7). Within bursa variable rounded transverse plicae occur. The vagina is short and narrow connecting atrium to capacious vaginal chamber (Fig. 7), passing via a short uterine duct to spermatophore complex. The contorted vas deferens inserts terminally with deep cream prostate which is appressed to off white uterine section. Albumen gland dull grey basally curved scoop-like with white hermaphrodite duct inserting near junction to become a thin duct slightly embedded, to moderately elongate globular pale grey talon densely covered with black capillaries (Fig. 13, T). Hermaphrodite gland a somewhat elongate mass of cream acini.

Digestive complex (Figs. 14, 15): anterior oesophagus swollen posterior to circumoesophageal ganglia expanding to crop then contracting to stomach. Posterior oesophagus recurving below stomach before emerging to rectum. Bilobate digestive gland pale orange, kidney cream elongate. Pallial organ cavity relatively short so that secondary ureter passes almost parallel to kidney and primary ureter (Fig. 15).

Muscular system: tentacular and buccal musculature latero-dorsal to oesophagus (Fig. 15). Buccal retractors pass below cerebral ganglia to connect with tentacular retractor dorsal to oesophagus. Pericardium appressed laterally and slightly ventrally to kidney. Heart with auricle very large in relation to ventricle, the auricle with small lateral lamellae, which do not cross the chamber (Fig. 11). Body cavity shallow.

Material Studied:

Voucher, National Museum of Victoria, registered number: F30169

One half mile north of Sandy Point, Waratah Bay, collected T. Muir, May 1970.

Whorl no.	Length.	Width.	Height.	Aperture length.	Foot length preserved.
Voucher					
3.3	12.8	9.9	5.5	7.5	28 mm
Other voucher material					
3.25	11.7	9.3	5.6	7.5	27.5
3.2	11.2	9.4	5.2	7.5	29
3.15	10.8	8.5	5.4	7.0	25
3.1	11.1	8.8	4.9	7.0	19
3.1	9.8	8.3	4.8	6.0	23
3.0	9.7	8.0	4.7	5.5	23
2.9	9.3	7.5	4.6	5.0	24
2.9	9.0	7.4	4.7	5.5	18
2.9	8.7	7.2	4.1	5.5	19
2.85	8.2	6.7	3.9	4.5	18.5
Other Material Studied					
Cape Liptrap Area. Collt. FSG-FNCV.					
3.25	10.0	8.8	4.5	6.0	13
3.1	9.0	8.0	4.1	6.0	22
2.25	8.5	6.5	4.4	5.0	—
Walkerville Area. Collt. J. Rigby & J. Muir, May 1970					
3.25	12.5	10.2	6.5	7.0	32
3.12	13.0	10.0	5.8	7.0	31
3.12	9.7	8.0	4.5	6.0	17
3.0	9.7	7.7	4.3	6.5	17
3.0	9.5	7.5	4.2	6.0	15
2.75	9.0	7.5	4.0	5.0	14
Mornington Area, Greenbush. Collt. M. Coulthard & T. Sault, 19/5/1974					
3.25	11.5	9.5	6.5	6.5	20

	3.12	10.0	8.7	4.8	6.0	22
	3.0	9.0	7.0	4.2	5.5	8.5
	2.9	9.3	7.0	4.0	6.0	20
Leongatha Area. Collt. E. Lyndon, May-June 1970.						
	3.1	12.1	10.1	5.3	8.0	30
	3.0	11.5	9.5	5.5	7.0	27
	3.0	11.5	9.0	5.0	8.0	28
	2.9	9.0	7.0	4.0	5.0	17
Whorl no.	Length.	Width.	Height.	Aperture length.	Foot length preserved.	
Korrumburra Area. Collt. J.A. Kershaw, 24/11/1893.						
	3.2	11.0	8.6	5.9	7.0	15 mm
	3.2	10.7	8.4	6.0	7.0	14.5
	3.2	10.2	8.6	5.1	6.0	—
	3.15	9.5	8.0	5.5	6.0	—
	3.0	9.3	7.3	5.0	5.0	—
	2.9	8.7	7.2	4.8	5.0	—
	2.8	8.5	6.9	4.5	4.5	—
	2.5	6.7	5.7	3.6	4.0	—
Trafalgar Area. Collt. W. Kershaw, August 1890.						
	3.0	10.8	8.6	5.0	6.0	18
	2.95	10.1	8.1	5.0	5.5	17
	2.95	10.5	8.2	5.0	6.0	—
	2.9	9.0	7.6	4.5	5.0	—
	2.5	6.4	5.3	3.4	4.0	—
Mirboo North. Collt. B. Thompson, 27/5/1972.						
	2.9	8.5	6.7	4.1	5.0	16
Foster Area. Collt. J.A. Kershaw, December-January 1909-10.						
	3.25	13.0	10.5	6.2	8.0	
	3.25	13.0	10.3	5.8	7.0	
	3.25	12.0(?)	9.4	—	—	
	3.1	12.5	10.4	5.8	7.5	
	3.0	9.5	7.4	4.5	5.5	
	2.9	9.0	7.0	4.0	6.0	
	2.75	7.5	6.3	3.9	3.8	
	2.5	5.4	4.3	2.5	2.9	

INTERSPECIFIC CHARACTERISTICS

Significant specific factors as understood were outlined by Dartnall & Kershaw (1978). Characteristics now accepted as most diagnostic of *Helicarion niger* for the present work include the spiral protoconch sculpture, the penial papilla and the penial ornament. The papilla is small, fleshy and rounded, *H. cuvieri* has no papilla but *H. rubicundus* has a complex digital structure incorrectly described as a verge. The penial ornament of longitudinal lines of papillae is distinct from that of *H. cuvieri* (Kershaw, 1979) while that of *H. rubicundus* (Kershaw, 1980) is very complex. The base of the penial retractor in these three species differs distinctly, that of *H. rubicundus* forming a false caecum. It is now known that a caecum does not occur in *Helicarion* s.s. *H. niger* has a symmetrical pallial cavity with the anal opening close to the kidney, without the prolongation of the ureter and rectum so apparent in the other two species. The transverse morphology of the kidney and primary ureter in *H. rubicundus* is particularly distinct from the elongate bulb of *H. niger*. The spermatophore is relatively simple with few spines but there is structural resemblance to that found in the two Tasmanian species, both of which are complex. No information is available on the caudal mucus colour as yet.

THE PROTOCONCH

The *Helicarion* protoconch offers some problems. In the case of *H. niger* there is a distinct degree of constancy as at present recognised. Nevertheless there are examples considered to be racial morphs which are not completely within the range of this

constancy. More material is needed to validate the apparent relationships. On a broader scale traces of probable ancestral relationships are suggested from study of data in hand. For example some Bass Strait morphs could be included in such an hypothesis. The Tasmanian species are distinct.

THE RADULA

Helicarion radulae are basically recognizable. But *H. niger* does not have the numerous large teeth of *H. rubicundus* nor the narrow elongate excavate rachidian of *H. cuvieri*. Instead it has a relatively broad mesocone with a distinctive depression adjacent the ectocones. *H. rubicundus* has the largest number of teeth per row known for the genus at present but other morphs are known with many more than the mean. *H. cuvieri* has the least with 33 below the mean and *H. niger* has 15 below the mean on present knowledge. The significance of this has still to be evaluated.

REMARKS

The type shell differs from the original Latin description in not being noticeably reddish as interpreted by authors from the use of the word 'rufa'. The latin description states clearly "4 whorls" but careful microscopic study indicates the presence of corrosion which could give the impression of more than the apparent 3.25 whorls of the type specimen. Compared to the French translation the last whorl is relatively large; very large seems an exaggeration. The dimensions given are not quite correct based on the ligne being equal to 2.256mm. This would be within the limits of error of the period. The French word used for the shell colour is "blonde". Gougenheim's Dictionaire Fondamental gives 'blonde' as a colour a little darker than yellow or gold. The animal is described and figured, its fate is unknown, but the description refers to its death. It is possible that it did not survive the voyage to France or that it was used for dissection.

Quoy and Gaimard refer to the size of the animal which is illustrated as elongate. The drawing obviously was made from a live crawling animal. They claim that despite the size the animal can be contained within the shell. Again one must discount the comment because although there is no doubt that the animal may withdraw more than the average *Helicarion*, no case of complete withdrawal has been observed. Nevertheless a larger shell is indicated which is in agreement with the 13.5mm length given. This is not unduly large and as the aperture varies and is often 1mm longer than wide, the length encountered is likely to be due to the prolongation, a probable gerontic factor. Shells larger than 3.5 whorls are very rare in *Helicarion*, an observation supported by both very old and new collections.

Not all the discrepancies can be disposed of through the reasoning put forward. Therefore it must be accepted that more than one or two specimens were collected. But as only one shell remains and there is no evidence to confirm whether any of the material was labelled 'type' there is no advantage in further speculation.

The authors refer to smaller specimens from the 'Port of King George', which being blackish have also been regarded as *H. niger*. This matter was explored again and there can be no doubt that it was King George Sound to which reference was made. But the animals referred to were certainly those at present known as *Luinarion castaneus* Pfeiffer 1853. Although there are specimens labelled thus in Paris none are from Quoy and Gaimard material. The record is the only one of the species having been collected on land in Western Australia. Ancey, as is well known, received his *Helicarion thompsoni* from a whaler and there appears no certain evidence that it was actually collected in Geographe Bay. This problem is one for the future but eliminates *Helicarion sensu stricto* from that part of Australia.

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Dr. Smith and Mr. Burn, has helped with critical reading of the manuscript. Appreciation is again due to the Science and Industry Endowment Fund for continue assistance plus equipment. Finally my thanks are due to the many collectors without whose field work this study would not be possible.



Helicarion niger Quoy & G.
VOUCHER
110 mm →

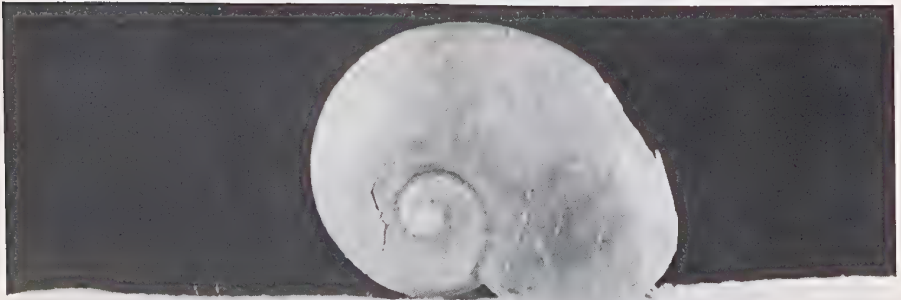
1. *Helicarion niger* (Quoy & Gaimard, 1832). Holotype. Museum Nationale d'Histoire Naturelle, Paris.



2. Central and lateral teeth x 1500. SEM by Dr. B.J. Smith.



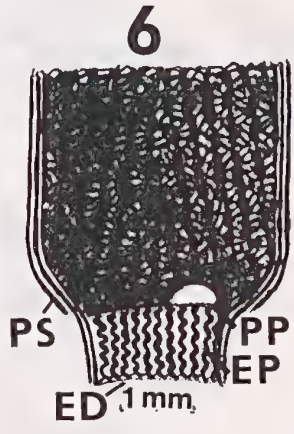
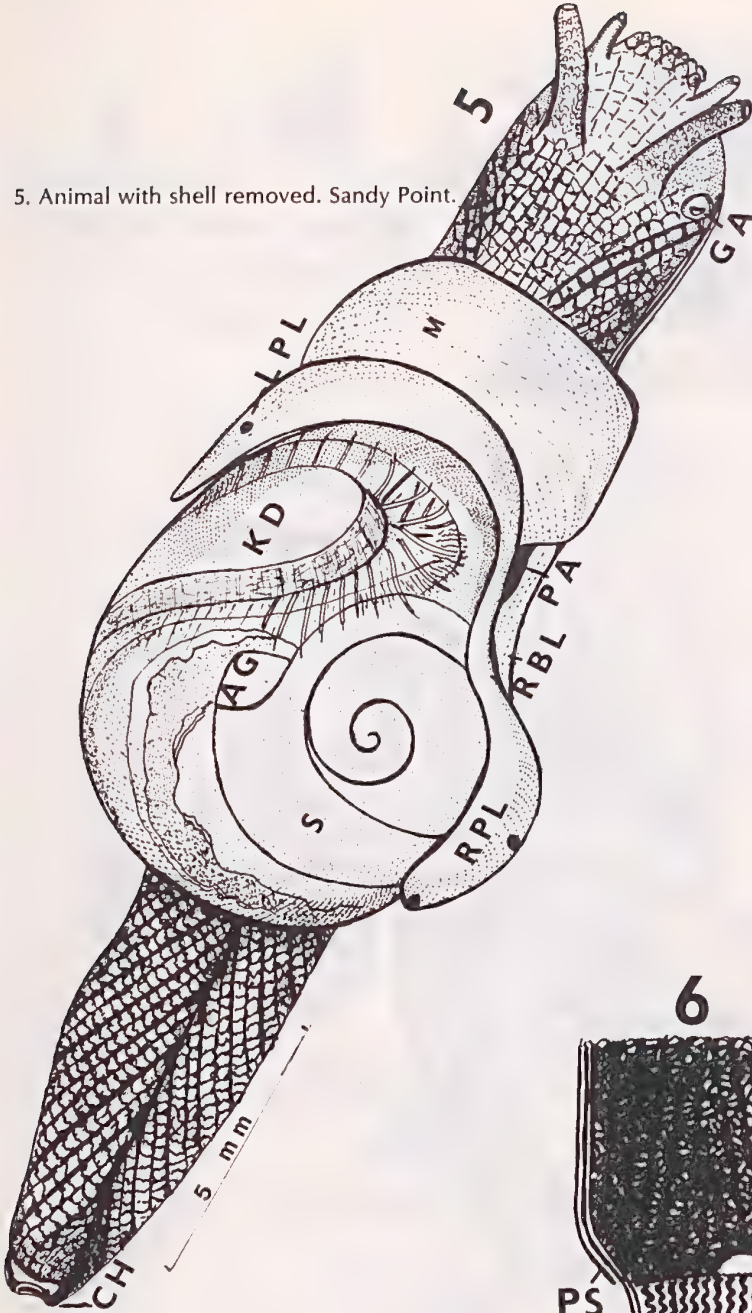
3. Lateral and marginal teeth x 780. SEM by Dr. B.J. Smith.



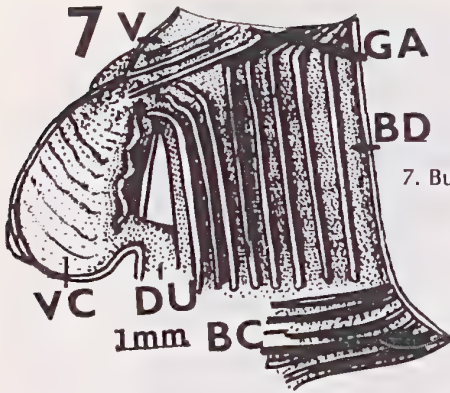
Villosa de Wollastoni
cont. vol. 11 fig 8-9.

4. Voucher specimen, Sandy Point, Victoria. Photo.R.C.K.

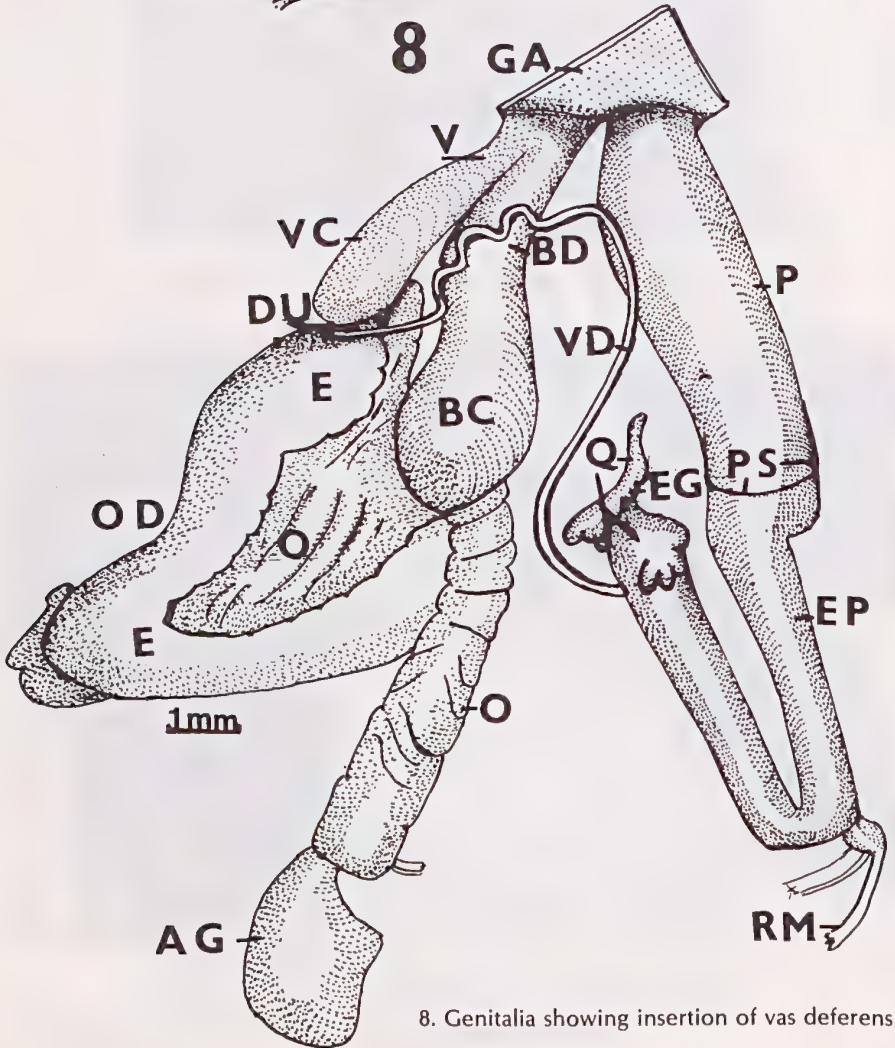
5. Animal with shell removed. Sandy Point.



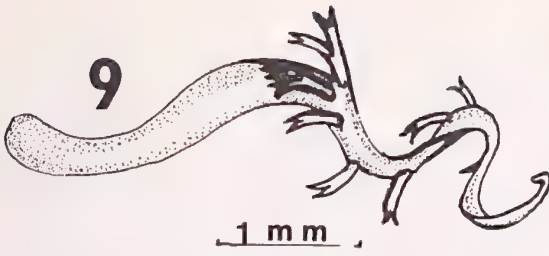
6. Penis, papilla, ornament and junction with epiphallus.



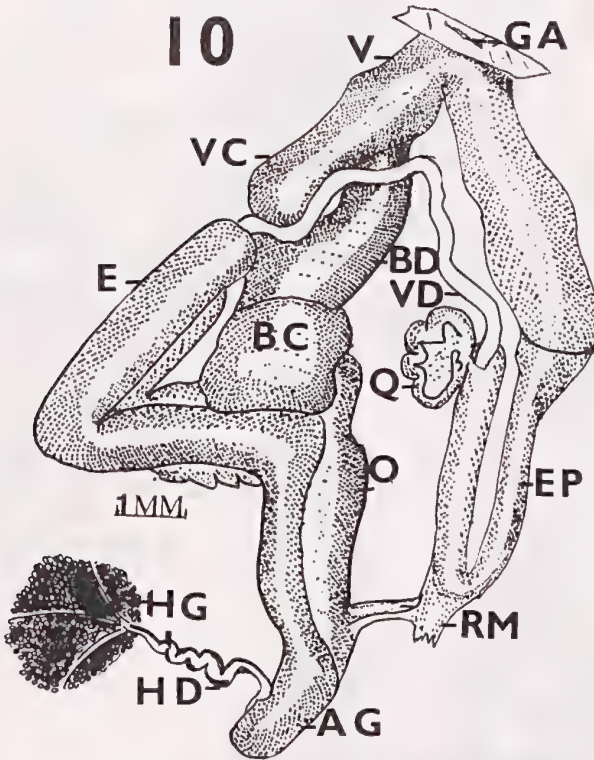
7. Bursa copulatrix and vagina, internal structure.



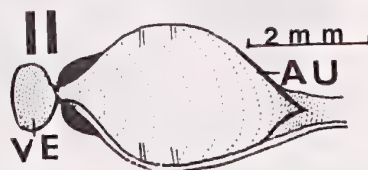
8. Genitalia showing insertion of vas deferens.



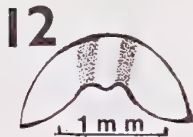
9. Spermatophore.



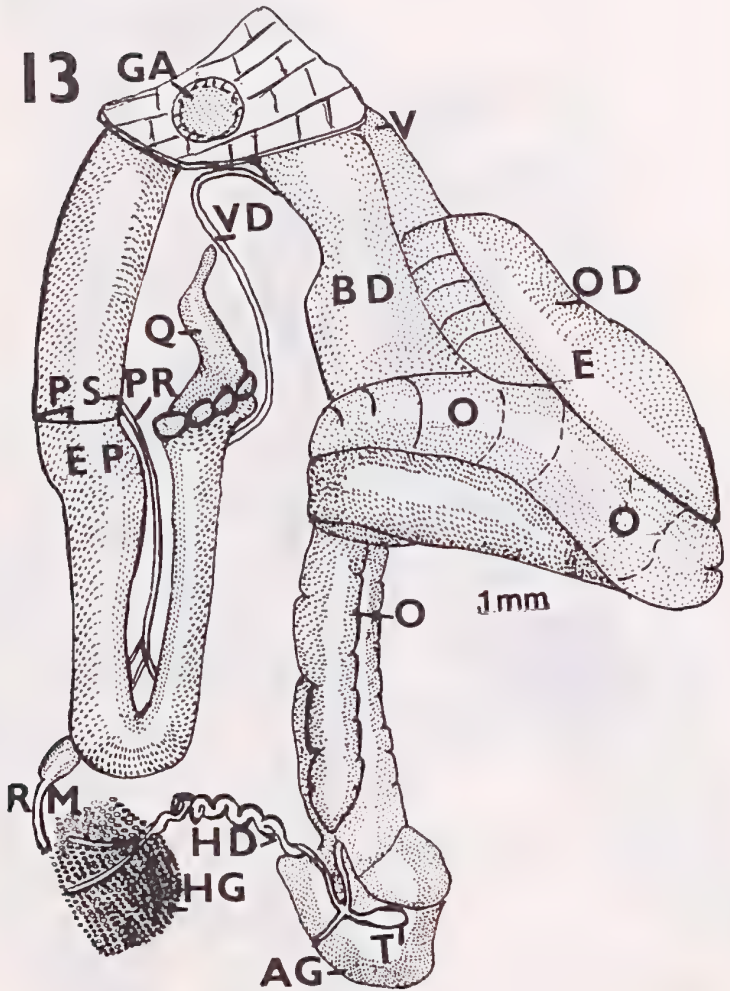
10. Genitalia, morph from Greenbush, Mornington.



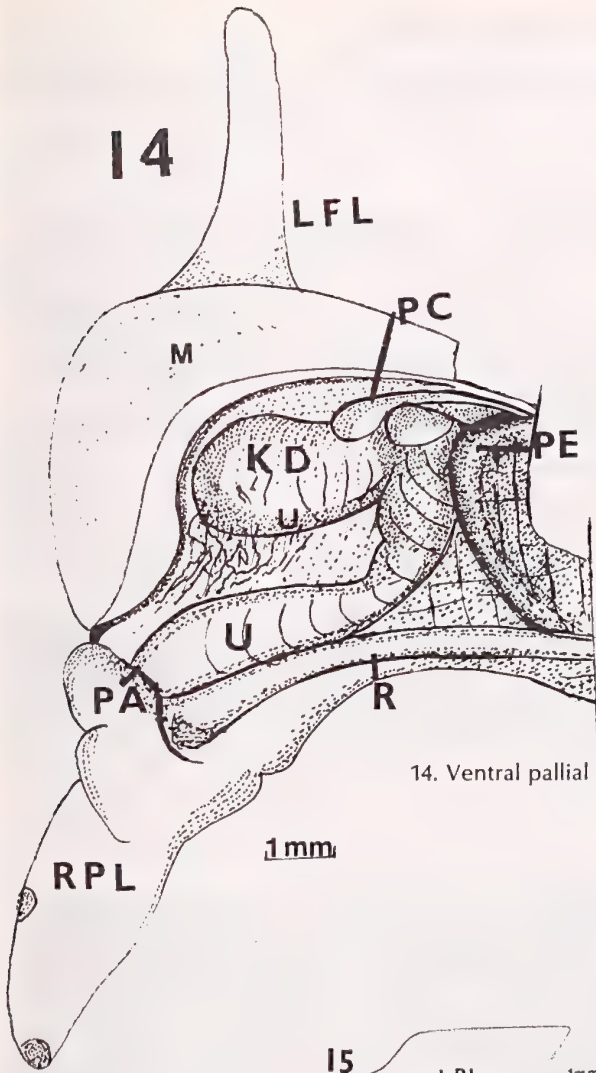
11. Heart removed from pericardium; auricle opened.



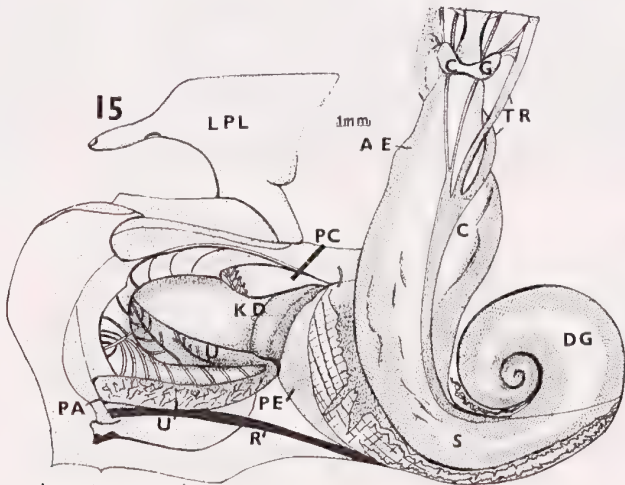
12. Jaw.



13. Genitalia, showing hermaphrodite duct and talon.



14. Ventral pallial region, Greenbush morph.



15. Digestive system, Sandy Point morph.